

Tesis doctoral: Aproximación metodológica a la obtención de modelos de percepción de molestias a partir de parámetros psicoacústicos en vehículos ferroviarios. Aplicación a trenes de alta velocidad.

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Comfort on board is, nowadays, one of the main reasons for the choice of transport means. Therefore, offering greater comfort is an advantage against other modes of mobility and the competition brought about by liberalization of rail passenger transport.

Noise is a key factor influencing passenger comfort. Therefore, in the late nineties, the first relevant acoustic comfort studies about high-speed vehicles began to appear. Although most studies focus mainly on the physical characterization, they have made some progress on trying to relate the interior noise and the passenger comfort.

The main objective of this research is to conduct a methodological approach to obtaining a psychoacoustic model, in order to predict the level of discomfort of passengers in conditions of commercial circulation, and make a comparison between different high-speed rail vehicles in terms of sound quality.

For this purpose, it was necessary to define an experimental methodology to obtain objective parameters of the background noise, as well as subjective measures of perception.

In particular, for the calculation of objective measures, this study develops a procedure to measure sound inside high-speed vehicles traveling at commercial speed, that allows their psychoacoustical comparison. The field study has identified the psychoacoustic variables that best describe the background noise, and how they vary according to their location within the vehicle.

To measure the perception, a methodology to assess the level of annoyance of representative sounds has been defined. This methodology has been validated as a result of the study, obtaining a high reliability in the measurement of discomfort levels.

The experimental methodology was applied in a field study, where the sound within six high-speed vehicles traveling at commercial speed was recorded. That field study allowed to record forty-six sounds that were subsequently measured in their level of discomfort by passengers.

In order to obtain a model to predict the level of annoyance, different psychoacoustic variables were analyzed: A weighted pressure level, loudness, sharpness and roughness of the sounds, along with the level of annoyance perceived by multiple linear regression. The model obtained has a predictive capacity of 90.8%.

Moreover, the research includes a comparison of the level of discomfort and a psychoacoustic characterization of the vehicles that were part of the field study.